

## Claims

5

1. A composition which comprises (a) at least one particulate material which expands on the application of heat and (b) at least one particulate nano-filler, together with at least one polymer and/or at least one curable monomer or  
10 oligomer.

2. A composition according to claim 1, in which component (a) comprises expandable graphite.

15 3. A composition according to either claim 1 or claim 2 in which component (b) is a nano-clay.

4. A composition according to any one of claims 1 to 3, which also comprises at least one other particulate material  
20 having fire retardant properties.

5. A composition according to claim 4, which includes at least one material selected from metal oxides/acids, hydrates, hydroxides, carbonates, sulphates, silicates,  
25 nitrides, molybdates and stearates.

6. A composition according to either claim 4 or claim 5, which includes at least one material selected from zinc or calcium borates, stannates or molybdates, zinc or magnesium  
30 stearates, ammonium molybdates, calcium hydroxide, aluminium trihydroxide, silicon oxide, silicon nitride, boron nitride, sodium metasilicate pentahydrate, potassium tetraborate tetrahydrate, magnesium hydroxide, magnesium silicates, titanium oxide, ferric oxide, molybdenum oxide, lead

phthalate, stannous chloride, and where appropriate, complexes thereof.

7. A composition according to either claim 5 or claim 6,  
5 which comprises at least two of said additional particulate materials having flame retardant properties.

8. A composition according to any one of claims 6 to 7, in which the said additional particulate material(s) is present  
10 in an amount of from 1 to 95% w/w, preferably 1 to 40% w/w.

9. A composition according to any one of claims 1 to 8, which comprises a curable monomer, oligomer and/or polymer which contains one or more groups selected from epoxy,  
15 acrylic, methacrylic, amine, hydroxyl, carboxyl, anhydride, olefinic, styrene, acetoxymethoxy, ester, cyano, amide, imide, lactone or urethane.

10. A composition according to any one of claims 1 to 9, in  
20 which the nano-filler is present in an amount of from 0.1 to 95% w/w, preferably 5 to 25% w/w based on the total weight of the composition.

11. A composition according to any one of claims 1 to 10, in  
25 which the expandable material is present in an amount of from 0.1 to 95% w/w, preferably 1 to 40% w/w.

12. A composition according to any one of claims 1 to 11, which is an adhesive, sealant or coating composition.

30

13. A cured article which comprises a polymer matrix in association with at least one particulate material which expands on the application of heat and at least one particulate nano-filler.

14. A process for the manufacture of a cured article according to claim 13, which comprising curing a curable composition according to any one of claims 1 to 12.

5

15. A process for the manufacture of a cured article according to claim 13, which comprises admixing at least one particulate material which expands on the application of heat, at least one particulate nano filler, and at least one curable monomer, oligomer and/or polymer, and subsequently curing the resulting mixture.

16. An article according to claim 13, which includes a fire-resistant coating which has been prepared by subjecting a polymer composition according to any one of claims 1 to 12 to sufficient heat to create a fire-resistant coating.

17. A method of making an adhesive bond, a seal, or a coating, which comprises applying a curable composition according to any one of claims 1 to 12 to a substrate and curing said composition.

18. An article according to either claim 13 or claim 16, which comprises a bond, a seal or a coating which has been formed by a method as claimed in claim 16.

19. A particulate composition for use as a flame retardant additive, which comprises (a) at least one particulate material which expands on the application of heat and (b) at least one particulate nano-filler.

20. Compositions based on reactive monomers, oligomers and polymers, which upon cure form adhesives, sealants, coatings or moulded objects, characterised with improved flame-

retardance and reduced smoke emission on burning, comprising a blend of polyorganosiloxane containing one or more functional groups selected from: amino, hydroxyl, methacrylic, acrylic, and epoxy groups and a second  
5 component, wherein the reactive species of the second component are selected from one or more of the following groups:

- a. epoxy-functional compounds and resins in combination with amino-functional compounds, resins, oligomers,  
10 polymers;
- b. hydroxy-functional compounds, oligomers, polymers in combination with isocyanate-functional monomers, dimmers, oligomers, polymers;
- c. methacrylic or acrylic functional monomers, methacrylic  
15 and acrylic functional oligomers or polymers.

21. Compositions based on reactive monomers, oligomers, polymers, which upon cure form adhesives, sealants, coatings or moulded objects, characterised with improved flame-  
20 retardance and reduced smoke emission on burning, containing a synergistic blend of expandable graphite and nano-clay and optionally one or more flame retardant additives and smoke suppressants from the group comprising of zinc borate, aluminium trihydroxide, ammonium octamolybdate, etc. wherein  
25 the reactive species are selected from the following groups:

- a. epoxy-functional compounds and resins in combination with amino-functional compounds, resins, oligomers, polymers;
- b. hydroxy-functional compounds, oligomers, polymers in  
30 combination with isocyanate-functional monomers, dimmers, oligomers, polymers;
- c. methacrylic or acrylic functional monomers in combination with methacrylic and acrylic functional oligomers or polymers;

- d. amino-functional polyorganosiloxane in combination with epoxy-functional compounds, resins or oligomers;
  - e. hydroxy-functional polyorganosiloxane in combination with isocyanate-functional monomers, dimers or  
5 oligomers;
  - f. methacrylated or acrylated polyorganosiloxane;
  - g. combinations in any proportions of groups a. and d.;
  - h. combinations in any proportions of groups b. and e.
  - i. combinations in any proportions of groups c. and f.
- 10 22. Compositions of Claim 20 or claim 21 where the polyorganosiloxane is polydimethylsiloxane.
23. A fire-resistant material which comprises a blend of  
15 polymers of which at least one is a silicone introduced into the polymeric matrix, by reactions other than condensation or hydrosilylation.
24. A curable composition containing one or more reactive  
20 monomers, oligomers and polymers, comprising at least one polyorganosiloxane containing one or more functional groups selected from amino, hydroxyl, methacrylic, acrylic, and epoxy groups, and a second component, wherein the reactive species of the second component are selected from one or more  
25 of the following groups:
- a. epoxy-functional compounds in combination with amino-functional compounds;
  - b. hydroxy-functional compounds, in combination with isocyanate-functional compounds;
  - 30 c. methacrylic or acrylic functional compounds.
25. A composition according to claim 24, which comprises an epoxy-functional compound together with an amino-functional polyorganosiloxane; an isocyanate-functional compound

together with a hydroxyl-functional polyorganosiloxane; or a methacrylic or acrylic functional compound together with a methacrylated or acrylated polyorganosiloxane.

5 26. A composition according to either claim 24 or claim 25, wherein the polyorganosiloxane is polydimethylsiloxane.

27. A composition according to any one of claims 24 to 26, which also comprises (a) at least one particulate material  
10 which expands on the application of heat and (b) at least one particulate nano-filler.

28. A composition according to claim 27, which has any one of the characteristics specified in any one of claims 2 to  
15 12.

29. The use of a composition according to any one of claims 20 to 28 as a fire-retardant, or in any application requiring enhanced fire resistance.

20